Los Alamos
ICF and Radiation Physics

ICF&RP Highlights
Spring 2001

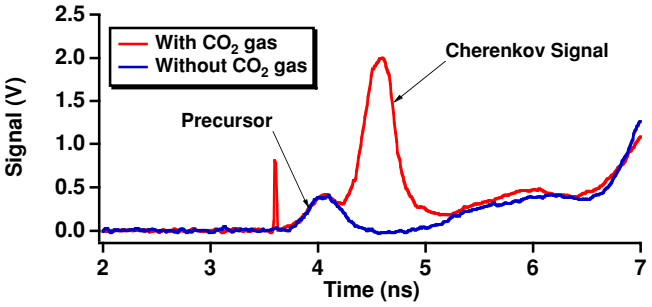
Volume 2, Issue 2

LALP-01-127

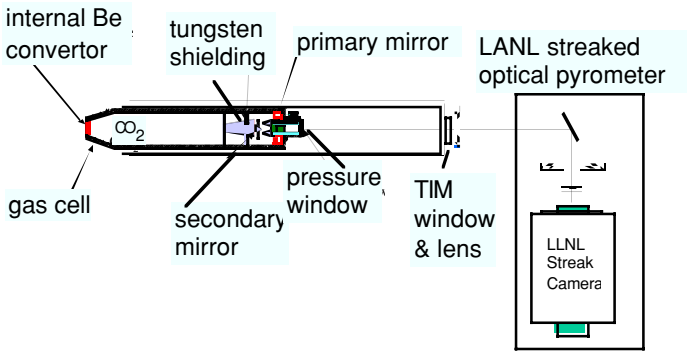
Gas Cherenkov Burn History Diagnostic-

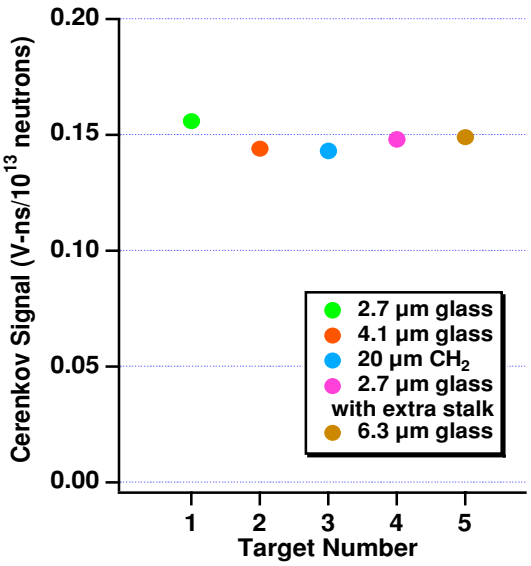
A new path to branching ratio measurements

Los Alamos National Laboratory has long-standing expertise in the diagnosis of the products (neutrons, gammas, and charged particles) from fusion reactions. In the past couple of years the ICF & Radiation Physics program has been a leader in the development and coordination of fusion product diagnostics for the National Ignition Facility (NIF). Part of this leadership has



been support for the development of advanced, "Phase 2" diagnostics that require considerable research and development and have significant near-term scientific payoff. This includes the development of a CO_2 gas Cherenkov detector for the DT fusion gammas emitted during the <100 ps of the fusion burn of an imploding capsule. Burn history diagnostics on present experiments detect the neutrons, but on NIF the stand-off distance and ion temperatures combine to create too much temporal dispersion in the neutrons, and gammas must be measured.





The Gas Cherenkov Burn History diagnostic, developed by Steve Caldwell (P-22), Carl Young (P-22), Joe Mack (P-DO) and Dick Lerche (LLNL) with design and engineering support from John Oertel, Jim Faulkner, Scott Evans, Keith Lash and Ralph Berggren of P-24, was initially fielded on ride-along shots on the OMEGA Laser at the Laboratory for Laser Energetics of the University of Rochester in June of 2000. While the gas cell system is designed to have less than 10 ps temporal dispersion, it uses a slow photomultiplier as a detector. Nevertheless it can resolve effects from (n,γ) reactions off of nearby objects (top figure). In September 2000, dedicated time led to confirmation that the time-dependent signal was not noise or background, and that the number of gamma-rays observed were independent of the amount or type of capsule shell and stalk material and thus were coming directly from the DT reaction (right figure). This method acquires data that will allow new branching ratio measurements of this reaction. In June 2001 the optical system will be mated to a streak camera (bottom figure) to provide time-dependent information during the fusion burn.

For more information about the Monthly Highlights content contact the editor of this edition: Allan Hauer hauer@lanl.gov To subscribe to Highlights send a request to Martha Austin at mea@lanl.gov. Please find this publication and other information on our web site: http://www.lanl.gov/ICF/